

REMARKS

Upon entry of this amendment, claims 1-6 will remain pending, with claim 1 being the sole independent claim.

Reconsideration and allowance of the application are respectfully requested.

Claim Of Priority

Applicants request that the Examiner acknowledge the claim of priority as well as receipt of the certified copy of Korean Application No. 10-2000-0057155, filed September 28, 2000, which certified copy was submitted on January 18, 2002.

Consideration Of Information Disclosure Statement

Applicants express appreciation for the inclusion with the Office Action of a copy of the initialed Form PTO-1449, whereby the Examiner's consideration of Applicants' Information Disclosure Statement filed January 18, 2002 is record.

Formal Drawings

Applicants note that the Office Action does not object to the drawings. Applicants therefore assume that the drawings submitted with the application are considered to meet all requirements, and no further action is required on the part of the Applicants with respect to submission of formal drawings.

Restriction Requirement

Applicants note each of the pending claims has been examined on the merits in the instant Office Action. Accordingly, it appears that the Restriction Requirement has been withdrawn based upon Applicants' Election with Traverse filed March 29, 2004.

Response To Objection To the Specification

Applicants note that the disclosure is objected to because it is asserted that at page 6, line 16, "polyesters" should be "polyethers".

In response, Applicants note that by the present amendment, "polyesters" has been changed to "polyethers". However, this change has been made at page 3, line 16.

Accordingly, this ground of objection should be withdrawn.

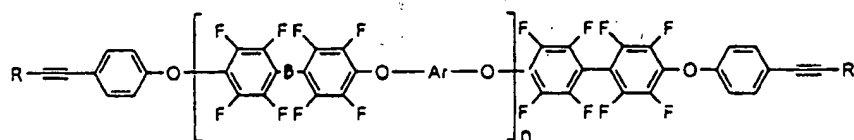
Response To 35 U.S.C. 103(a) Rejection

Claims 1-6 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Korea 10-226442 (hereinafter "Korea '442") taken alone or in view of Xu et al. (hereinafter "Xu"), U.S. Patent No. 6,306,563, and Snyder et al. (Synder), U.S. Patent No. 4,443,349.


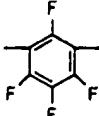
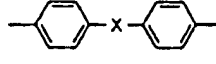
In response, Applicants note that the deficiencies of Korea '442 are discussed in their specification. In particular, in Applicants' specification at page 2, beginning at line 5, after discussing problems with known fluorinated poly(arylene ether) notes that:

In an attempt to overcome the problem with the fluorinated poly(arylene ether), Korean Patent No. 226442 discloses a fluorinated poly(arylene ether) having a thermosettable acetylene end group. The polymer disclosed in this patent can provide a thin film having an excellent chemical resistance by a thermal cross-linking process and can be used applied to fabricate the optical devices. However, the fluorinated poly(arylene ether) is disadvantageous in that it is high in optical birefringence as it has an intrinsically aromatic, rigid rod-like molecular structure. Also, the aromatic fluorinated poly(arylene ether) has a refractive index of 1.50 or above at a wavelength of 1550 nm, which is significantly different from that of optical fibers (1.46). For this reason, the polymer has high reflection loss at an interconnection with the optical fibers.

Moreover, a review of Korea '442 reveals that it discloses fluorine substituted polyarylene ether having thermosetting ethynyl radical obtained by the thermal polycondensation of decafluorobiphenyl, aromatic diol having various substituents, and ethynyl phenol derivatives. The compound disclosed in Korea'442 is a fluorinated poly(arylene ether) having an ethynyl group, represented by the following general formula, which is basically a full aromatic homopolymer.



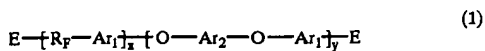
where in, B is O, $\text{C}(=\text{O})$ or SO_2 , R is H or phenyl group

Ar is selected aromatic group in , , ,

X is $-\text{C}(\text{CF}_3)_2$, $-\text{CO}-$, $-\text{SO}_2-$, $-\text{O}-$, or $-\text{S}-$.

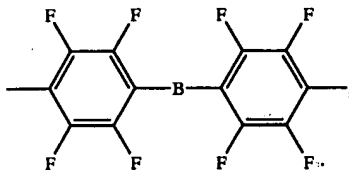
n is polymerization degree, natural number 1-100

In contrast, Applicants' independent claim 1 is directed to fluorinated polyethers having a perfluorinated aliphatic group at a main chain, which are represented by the following formula (1):



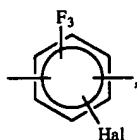
where R_F represents $OCH_2(CF_2)_nCH_2O$, or $OCH_2CF_2O(CF_2CF_2O)_nCF_2CH_2O$, where n is a natural number ranging from 1 to 12;

Ar_1 represents



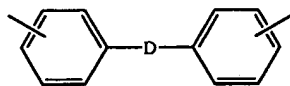
where B is not present or a $C=O$ group, or

Ar_1 represents



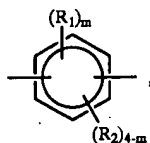
where Hal is one selected from F , Cl , Br and I ;

Ar_2 represents



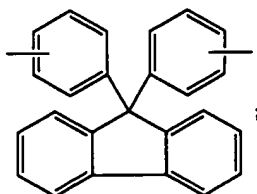
where D is one selected from $-C(CF_3)_2$, $-C(CH_3)_2$, $-CO-$, $-SO_2-$, $-O-$ and $-S-$, or

Ar₂ represents

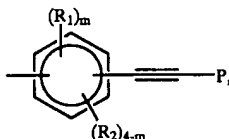


where R₁ and R₂ are the same or different and each independently represents a halogen atom selected from F, Cl, Br and I, and m is a natural number of 1-3, or

Ar₂ represents



E represents H, or



where P is H or a substituted or unsubstituted phenyl group;

x is a number ranging from 0.1 to 1.0;

y is 1.0-x.

The difference in structure with respect to the fluorinated polyethers having a fluorinated aliphatic group at a main chain recited in Applicants' claims results in quite different physical and chemical properties between the two polymers. By thermally crosslinking the homopolymer disclosed in the cited Korea '442, a thin film with superb chemical resistance can be provided. However, the fluorinated poly(arylene ether) is of high optical birefringence as it has an intrinsically aromatic, rigid rod-like molecular structure.

Additionally, the aromatic fluorinated poly(arylene ether) of Korea '442 has a refractive index of 1.50 or higher at a wavelength of 1550 nm, which is somewhat different from the requirement for optical fibers of a refractive index of 1.46. For this reason, this homopolymer shows high reflection loss at an interconnection with optical fibers.

Intensive studies on optical waveguides conducted by the present inventors, resulted in the finding that the introduction of a flexible fluorinated aliphatic chain into a main chain structure of fluorinated polyethers can reduce the optical birefringence between TE and TM modes, as well as allowing the polyethers to have a refractive index close to 1.46, that is, the refractive index of the optical fibers.

Further, in the case of polyethers having a fluorinated aliphatic group according to the present invention, their refractive indices were found to be precisely controlled by varying the comonomer, that is copolymerized with the polyethers.

In addition, it was also found that an increase in fluorine content could reduce the optical absorption loss caused by a vibration mode of C-H bonds in the polymer structure.

Applicants' copolymers, including fluorinated polyethers having a fluorinated aliphatic group in the main chain, exhibits low optical propagation loss, high thermal stability, low optical birefringence and precise refractive index controllability.

Thus, as recognized in the rejection of record, Korea '442 does not teach each and every feature recited in Applicants' claims. However, the deficiencies of Korea '442 are not overcome by the asserted modifications set forth in the rejection.

Applicants initially note that the rejection is without appropriate basis in asserting that Korea '442 can be modified based upon its own disclosure. The Examiner is

reminded that there must be some motivation in the prior art to make the asserted modification. In the instant situation, a mere assertion without any supporting documentary evidence is inappropriate.

Moreover, Applicants respectfully submit that the deficiencies of Korea '442 are not overcome by the disclosures of either of Xu and/or Snyder.

Applicants respectfully submit that one having ordinary skill in the art would not have been motivated to combine the diverse disclosures of Korea '442, Xu and Snyder. Thus, Korea' 442 is directed to a fluorine substituted polyarylene ether having thermosetting ethynyl radical, its method of production and an optical device using the same. In contrast, Snyder is directed to fluorinated aliphatic polyalkylether lubricant with an additive composed of an aromatic phosphine substituted with perfluoroalkylether groups. Applicants respectfully submit that there is no motivation to combine such diverse disclosures relating to fluorinated aliphatic polyalkylether lubricants which are used for engine oils, hydraulic fluids and greases, and a fluorine substituted polyarylene ether designed for an optical device.

Moreover, even if for the sake of argument, the disclosures were combined, Applicants respectfully submit that Snyder discloses a single molecular structure of triphenyl phosphine having a perfluoro ether group. Because this compound is not synthesized by the polymerization of fluorinated aliphatic alcohol to poly(ether), Snyder describes a compound that is different from the subject invention.

With respect to Xu, Applicants note that Xu is directed to fluorinated aliphatic ether moieties which have an acryl group or an epoxide group introduced at its terminus which

are utilized simply due to their high applicability to optical elements. However, the reactions and resulting products of this cited patent are quite different from those of the subject invention. There is no motivation to arrive at Applicants' compounds following the disclosures of Xu and Korea '442.

The rejection also makes a very general assertion that it would have been obvious to add a fluorinated aliphatic group to the fluorinated polyethers through routine experimentation, optimum ranges and use of preferred material. However, the rejection is silent as to any type of routine experimentation, optimum ranges and use of preferred materials. Therefore, if this aspect of the rejection is maintained, the Examiner is respectfully requested to have the rejection explain what routine experimentation is to be performed and why such routine experimentation will be performed; what is meant by optimum ranges and how these optimum ranges relate to the rejection; and what is intended by use of preferred materials.

Still further, the rejection contends that it would have been obvious at the time of the invention to construct or provide Korea '442 with the claimed fluorinated polyethers having a fluorinated aliphatic group as that of the instant invention for obtaining the desired optical characteristics required in certain optical devices. However, the rejection does not explain where the prior art teaches or suggests modification of Korea '442 to include fluorinated aliphatic groups to obtain optical properties and what these desired optical properties are.

Thus, Applicants respectfully submit that the only teaching or suggestion that would lead one having ordinary skill in the art to arrive at Applicants' invention is within

Applicants' disclosure, and the use of such disclosure by the Examiner is improper. In order to support the conclusion that the claimed invention is either anticipated or rendered obvious over the prior art, the prior art must either expressly or inherently teach the claimed invention or the Examiner must present a convincing line of reasoning why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. Ex parte Clapp, 227 U.S.P.Q. 972 (B.O.A. 1985).

Additionally, each of the dependent claims is patentable over the prior art of record in view of the fact that each of these dependent claims includes the limitations independent claim 1. Moreover, each of the dependent claims is patentable over the prior art of record because it would not have been obvious to one having ordinary skill in the art to incorporate such dependent claim features into the invention as more broadly recited in independent claim 1.

Accordingly, the 35 U.S.C. 103 rejection should be withdrawn as improper, and all of the claims should be indicated as allowable over the prior art.


CONCLUSION

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejection of record, and allow each of the pending claims.

Applicants therefore respectfully request that an early indication of allowance of the application be indicated by the mailing of the Notices of Allowance and Allowability.

Should the Examiner have any questions regarding this Response, the this application, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,
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